The Beagle, Records of the Northern Territory Museum of Arts and Sciences, 1991 8(1):1-10

THE FROG FAUNA OF MELVILLE ISLAND, NORTHERN TERRITORY.

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ABSTRACT

Fourteen speeies of frogs were found on Melville Island. Details are provided of their distribution, biology and relative abundanee. The advertisement calls of *Crinia remota, Sphenophryne adelphe* and *Uperoleia inundata* are documented. The frog fauna of Melville Island is compared with the faunas of Darwin, the Cobourg Peninsula and Groote Eylandt. The signifieance of the apparent absence of *Litoria rubella* and the comparatively low numbers of *Cyclorana australis* is explored.

KEYWORDS: Amphibia, Hylidae, Leptodactylidae, Microhylidae, *Cyclorana australis, Litoria bicolor, Litoria caerulea, Litoria microbelos, Litoria nasuta, Litoria pallida, Litoria rothii, Litoria tornieri, Crinia remota, Limnodynastes convexiusculus, Limnodynastes ornatus, Notaden melanoscaphus, Uperoleia inundata, Sphenophryne adelphe*, Melville Island, fauna list, speeies distribution.

INTRODUCTION

Beeause frogs possess a semi-permeable skin they are unable to eross marine barriers other than by passive transportation. Accordingly, insular Australian frog faunas represent peripheral, continental populations, most of which were isolated in the Holocene or Late Pleistocene by marine transgressions upon the continental plate. Interest in island frog faunas tends to foeus upon the nature and extent of any divergence from mainland populations that they exhibit.

There is a large number of islands situated upon the Australian continental shelf. While some of these lack freshwater sources, and ean be assumed to be unable to sustain frog populations, the majority have not been subjected to surveys designed to establish the existence and diversity of frog faunas. In fact the frog fauna of the largest island, Melville Island off the coast of Darwin, is unknown.

In January 1990 we spent 10 days on Melville Island to determine the nature of the frog fauna. Beyond that documentation process, we wished particularly to obtain data enabling us to compare the fauna with the adjacent Cobourg Peninsula reported by Cogger and Lindner (1974), and with Groote Eylandt in the Gulf of Carpentaria reported by Tyler *et al.* (1986), and Darwin, reported by Tyler and Davies (1986).

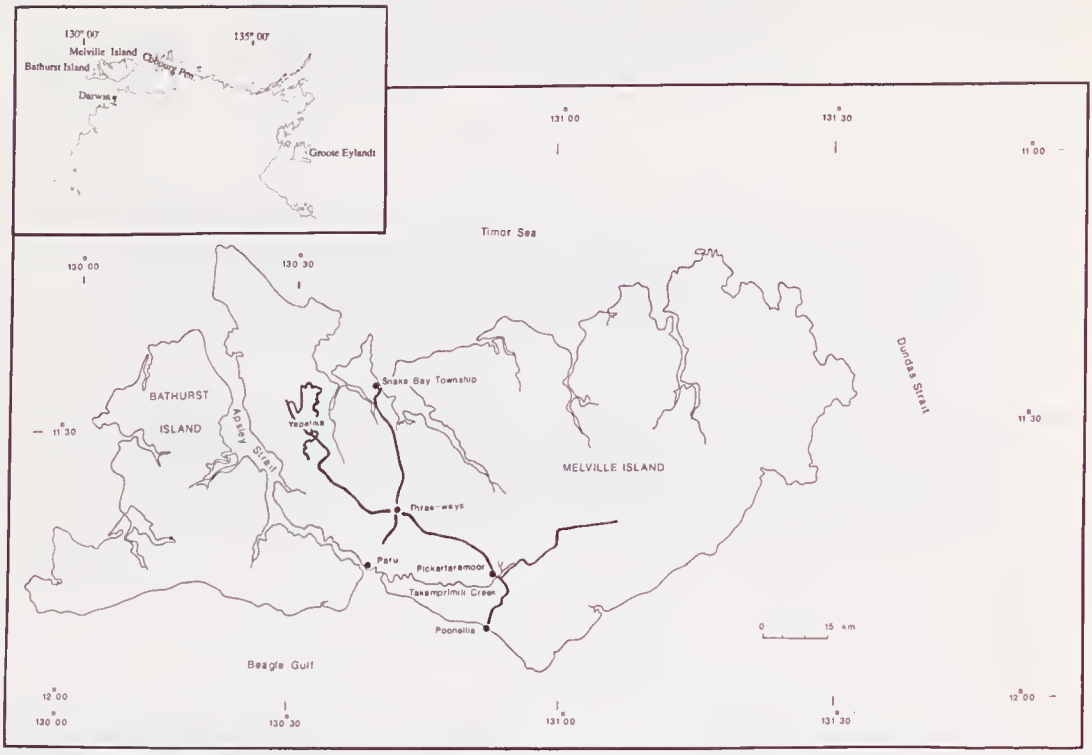
MATERIAL AND METHODS

The collection obtained has been deposited in the Northern Territory Museum of Arts and Sciences (NTM) and the South Australian Museum (SAM).

Specimens were collected at sites in elose proximity to unsealed roads and tracks on the western half of the island (Fig. 1). By day we sought sites that we considered potentially productive, whilst at night we visited these sites and also stopped frequently elsewhere to listen for advertisement calls. Sample sizes obtained reflected interest in taxa rather than our ability to obtain specimens.

Methods of measurement and the abbreviations used in the text follow Tyler (1967).

Advertisement calls were recorded in the field using a Sony TC-D5PRO cassette re-



Figs 1-2. 1, Melville and Bathurst Islands. Bold lines are roads and tracks along which collecting and recording was conducted. **2, (Insert)** Northern portion of the Northern Territory showing the physical relationships of the faunal sampling sites compared in Table 3.

corder (tape speed 4.74cm sec^{-1}) and a Beyer M88 dynamic microphone. After locating a calling individual, the microphone was placed close to the male and a series of calls recorded: an attempt was then made to collect the recorded individual. Wet bulb air temperature was recorded at the terrestrial calling sites (no specimens reported here were calling in water) using an electronic thermister thermometer (Takara Digimulti Model D611) with a resolution of 0.1°C.

Recordings were analyzed on a DSP 5000 digital Sona-Graph (Kay Elemetrics) with playback on a Nakamuchi Dragon cassette tape recorder. Overall variations in tape speed (both recording and playback) are estimated to be less than 0.5%. Frequency responses of all audio-electronic components are close to linear within the relevant frequency range (2000-5000 Hz). The built-in set up No. 10 was used for analysis on the Sona-graph.

MELVILLE ISLAND

Melville Island is located approximately 60 km north of Darwin and is separated from Bathurst Island by the narrow Apsley Strait. Situated south of latitude 11° the island appears as an isolated portion of the Cobourg Peninsula (Fig. 2).

The island is of low relief, with undulating laterite rises and dissected low plateaux up to 100 m above sea level. The most common soils are Sandy Red Massive Earths (Gn. 2.11., 14 *sensu* Northcote *et al.* 1975). Adjacent to the numerous perennial springs, soils are poorly drained and acidic. Narrow corridors of dense rainforest (jungle) flank the streams, whereas on the greater portion of the island the vegetation is predominantly open eucalypt forest, tall open shrubland or low woodland.

The wet season extends from October or November to March or April. The recording of

rainfall commenced in 1963, and pooled data indicate a mean rainfall of 1973 mm falling on 9-21 raindays (mean) (Haines 1986). Of the sites visited, Pickertaramoor had a mean rainfall of 1600 mm, Snake Bay 1563 mm, and Three-Ways 1964 mm (Van Cuylenberg and Dunlop 1974). Mean daily maximum and minimum temperatures are 18.2 and 32.9°C.

Melville Island is sparsely populated and settlements are concentrated on the western half of the island. There is no land access to the east coast.

SYSTEMATICS

Family Hylidae

Cyclorana australis (Gray)

Material. NTM R16048-50, SAM R35115, 5-10 km N of Pickertaramoor; SAM R35117, Poonellie Rd; SAM R35116, nr Pickertaramoor; NTM R16051-52, R16082, 5 km N of Poonellie.

Distribution and Abundance. The specimens collected were the only ones sighted on the island. We were surprised at the scarcity of the species, for at localities in northern Australia that we have visited *C. australis* is invariably abundant and one of the most conspicuous components of the terrestrial fauna.

Remarks. A small chorus was heard at Pickertaramoor during rain on the night of 23.1.90. A specimen collected on the road on 21.1.90 regurgitated an adult *L. rothii*.

Litoria bicolor (Gray)

Material. NTM R16083-85, SAM R35138-40, Yapalika; NTM R16086-90, SAM R35165-70, Snake Bay.

Distribution and Abundance. The habitats of the two localities at which we found this species were both adjacent to permanent water. At each site very large numbers of individuals were present.

Litoria caerulea (White)

Material. One specimen was collected approximately 24 km E of Three-Ways, and one approximately 10 km N of Three-Ways. The specimens have been retained alive.

Distribution and Abundance. *L. caerulea* is patchily distributed on the island. We saw only the two specimens collected and heard three or four others at each of the sites. None was seen or heard around the houses at Pickertaramoor, where we expected it to be abundant.

Litoria microbelos Cogger

Material. NTM R16091, SAM R35162-64, Yapalika; NTM R16092-98, SAM R35165-70, Snake Bay.

Distribution and Abundance. This species was located at two sites where it was associated with *L. bicolor*. Vast numbers of individuals were heard calling.

Remarks. At each of the sites, groups of potential predators were congregated around the calling frogs. At Yapalika *L. nasuta* was found perched on dry grasses up to 0.5 m above the ground: these frogs were not calling but apparently foraging with nearby *L. microbelos* the likely prey. At Snake Bay as many as five spiders (*Dolomedes* sp. ?) would be found gathered within 10 cm of frogs that were calling from floating debris on the surface of a swamp. *Dolomedes* is a known predator of frogs (McKeown 1943).

Litoria nasuta (Gray)

Material. NTM R16063-65, SAM R35157-59, 1.5 km N of Three-Ways; NTM R16067, 5 km NW Pickertaramoor; SAM R35160, Snake Bay; SAM R35161, Yapalika.

Distribution and Abundance. This species appeared widely dispersed and was heard at a number of localities intermediate between those listed above. Choruses of 1-2 dozen individuals were heard on several occasions.

Litoria pallida Davies, Watson and Martin

Material. NTM R16070-71, SAM R35129-31, 5 km NW of Pickertaramoor; NTM R16068-69, SAM R35132-33, 1.5 km N of Three-Ways.

Distribution and Abundance. We heard and collected the species only at the two localities listed. Following rain large choruses congregated around temporary pools there.

Litoria rothii (de Vis)

Material. NTM R16060, Yapalika; NTM R16059, 1.5 km N of Three-Ways; NTM R16061, SAM R35123-24, 5 km N of Poonellie; NTM R16062, SAM R35125, Snake Bay.

Distribution and Abundance. Although widely distributed, we encountered no more than six individuals at any locality.

Litoria tornieri (Nieden)

Material. NTM R16077-81, SAM R35146-51, 5 km NW of Pickertaramoor; NTM R16072-76, SAM R35152-56, 1.5 km N of Three-Ways.

Distribution and Abundance. This species appears to exist in dense, discrete and widely separated communities.

Family Leptodactylidae
Crinia remota Tyler and Parker

Material. NTM R16103-04, SAM R35134-37, Yapalika; NTM R16102, 1.5 km N of Three-Ways; NTM R16105, Snake Bay.

Distribution and Abundance. The species also was heard at the springs that form the source of the Takamprimili Creek approximately 3 km west of Pickertaramoor. It was very common in flooded grasslands within a 5 km radius of Yapalika.

Call. Table 1 shows a comparison between the published values of call attributes of *C. remota* (Tyler and Parker 1974) and those obtained from a call of an individual at Yapalika. Clearly the calls are very similar and confirm the identity of the species as *C. remota*.

Limnodynastes convexiusculus (Macleay)

Material. NTM R16053, SAM R35120, Yapalika; NTM R16054, SAM R35121, Snake Bay. An additional four specimens from Snake Bay were retained alive.

Distribution and Abundance. The site at which we heard most specimens was the extensive permanent marsh at Snake Bay, where approximately 12 males were calling from refuges in shallow water. Two were also heard (but not collected) at a freshwater swamp adjacent to the beach at Poonellie.

Limnodynastes ornatus (Gray)

Material. NTM R16056, 1 km N of Three-Ways; NTM R16057, SAM R35122; Paru Road; NTM R16058, Three-Ways.

Distribution and Abundance. The number of specimens collected reflected the scarcity of the species. However we did not hear calling and our vouchers therefore were obtained fortuitously.

Notaden melanoscaphus Hosmer

Material. NTM R16055, SAM R35118-19, Yapalika. An additional eight specimens from the same locality have been retained alive.

Distribution and Abundance. We encountered this species only once following heavy rainfall at Yapalika.

Remarks. Frogs were calling on 19.1.90 from clear water no more than 2 cm deep. Amplexus was observed, and one amplectant pair produced fertile eggs.

Uperoleia inundata Tyler, Davies and Martin

Material. NTM R16099-101, SAM R35126-28, Yapalika.

Distribution and Abundance. Occasional calling individuals were heard at various points between Three-Ways and Snake Bay, but it was only at Yapalika that we heard a large chorus.

Call. Table 1 shows a comparison between the published values of call attributes of *U.*

Table 1. Comparison of a call of *Crinia* and *Uperoleia* from Melville Island with published values for *C. remota* and *U. inundata*. The published values for *U. inundata* shows the ranges and means (in italics) of call attributes.

Species	No. of Pulses	Duration (ms)	Pulse repetition rate (pulses/s)	Dominant Frequency (Hz)	Effective Temperature (°C)
C. remota [1]	14	720	18.1	4250	
Crinia, Yapalika M.I.[2]	16	675	22.4	4280	26.3
U. inundata[3]	11-*12.5*-14	127-*145.5*-160	80.0-*85.9*-89.7	2300-*2600*-2800	24.0-26.0
Uperoleia, Yapalika M.I.[4]	12	144.1	76.3	2370	26.3

([1] Tyler and Parker (1974), [2,4] this study, [3] Tyler *et al.* (1981))

Fig. 3. *Sphenophryne adelphe*, Pickertaramoor, Melville Island.

inundata (Tyler *et al.* 1981) and those obtained from a call of an individual at Yapalika. Clearly the calls are very similar and confirm the identity of the species as *inundata*.

Family Microhylidae
Sphenophryne adelphe Zweifel
(Figs 3, 5)

Material. NTMR16106-11, SAMR35109.14, Pickertaramoor.

Distribution and Abundance. We heard the distinctive call of this species at almost every site that we visited. At Pickertaramoor we collected it on the lawns around the houses. Densities were as high as 6/100 m^2. One of the individuals is shown in Fig. 3.

Habitat. As indicated by the distribution, *S. adelphe* occurred in a wide variety of habitats in open country. Specimens were heard at the periphery of plantations of *Pinus caribaea*, and in rainforest.

Call. At Pickertaramoor individuals were calling in the open on leaves around houses. All but two were upon the ground either exposed or beneath leaves. One specimen was calling from the summit of a heap of grass clippings at the base of a tree, and another was calling approximately 30 cm above the ground from the low branches of a shrub. Traditionally Australian microhylid frogs are considered to be rainforest species. Our observations demonstrate that *S. adelphe* is an exception.

As reported by Zweifel (1985) the call consists of "a moderately rapidly repeated series of high-pitched peeps" and is illustrated in Figure 4. Our more detailed analysis of calls from three individuals (Table 2) indicates similar values to those provided by Zweifel (1985) from calls of two individuals (one call incomplete), with no temperature data.

Number of notes per call was relatively consistent within individuals and varied from 24-30 (mean = 26.8) between individuals. The lowest value (7) given by Zweifel (1985) seems to be extremely low and likely to be from an incomplete or interrupted call. Even so our data suggest a higher number of notes per call is typical of the species and consistent with an individual reported by Zweifel (see Table 2), but not included in his analysis. Similarly, values for call duration are longer in our calls than in Zweifel's analysis; these differences are due to the lower number of notes per call in Zweifel's sample. Note durations vary within each call with the middle notes tending to be

Fig. 4. A, Wave form display of a call of *Sphenophryne adelphe* (SAM R35109), Pickertaramoor, Melville Island. Wet-bulb air temperature 25.4°C. B, Wave form display of the middle note (16th) of the call of *S. adelphe* shown in A. C, Power spectrum of call of *S. adelphe* shown in A.

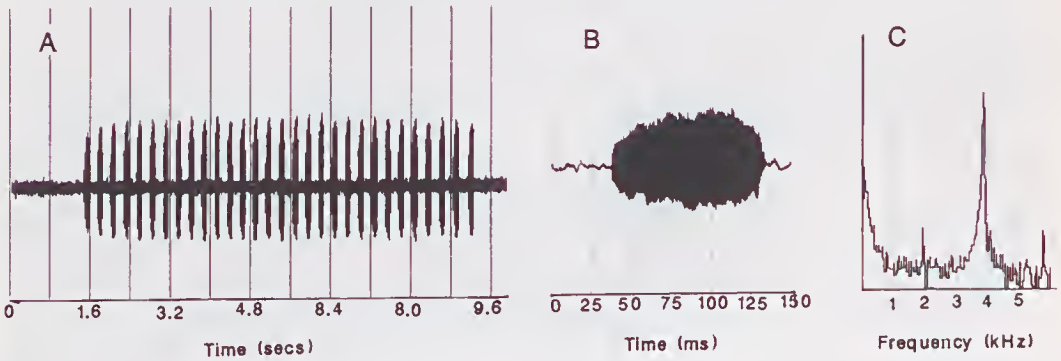


Table 2. Comparison of calls of *Sphenophryne* from Melville Island with published values for *S. adelphe* (Zweifel 1985), showing ranges and means (in italics).

Locality	No. of notes per call	Call Duration (s)	Note Duration (s)	Note Repetition Rate (notes/sec)	Dominant Frequency (H_z)	Wet Bulb Temperature (°C)
Croker I., NT	7-*14.6*-20[1]	1.9-*3.56*-4.8[1]	c. 0.12	3.6-*4.08*-4.3	c. 4600	unknown
Pickertaramoor #1 (SAM R35109)	30 (n=4:29-*29.5*-30)	7.83	1st .11 mid .098 last .10	4.90	3840	25.4
Pickertaramoor #2 (not collected)	24 (n=5:24-*24.2*-25)	6.03	1st .11 mid .098 last .11	3.89	3760	25.8
Pickertaramoor #3 (not collected)	29	8.53	1st .18 mid .12 last .14	3.35	3520-*4080*-4400[2]	25.1

[1] Values for a second individual available to Zweifel (1985) but not included in his analysis had a greater call duration (>7 sec) and number of notes per call (>31) but a similar note repetition rate (4.4).
[2] Three peaks of equal intensity.

shorter (Table 2); but the range of durations extends over the value estimated by Zweifel (1985). Note repetition rate is similar in both studies. Even though they are smaller, the dominant frequency of Melville Island individuals is generally lower than the Croker Island specimens, although the third individual recorded had three equal peaks of energy in the power spectrum of its call (Table 2), and the upper value (4400 Hz) approaches that reported by Zweifel (1985).

Remarks. In the original description Zweifel (1985) compared *S. adelphe* with the sibling species *S. gracilipes* (Fry), and noted that he could not distinguish them on morphological grounds. Zweifel had not seen a living specimen of *S. adelphe*, and observed, "it would be of interest to know if *S. adelphe* has the orange groin and axilla color noted for Australian *gracilipes*". We can establish that the *S. adelphe* collected by us lacks the orange patches, so providing a simple key character to distinguish the allopatric species.

Zweifel reported that the largest specimen that he examined was a female of 21.9 mm S-V, and stated that males attain at least 19.1 mm. The single female obtained by us was gravid at 18.0 mm, whilst the adult (calling) males ranged 13.0-16.9 mm. Ranges of proportions employed by Zweifel (1985) are shown below, with those cited by Zweifel in parentheses: TL/S-V 0.40-0.49 (0.43-0.49), E-M/IN

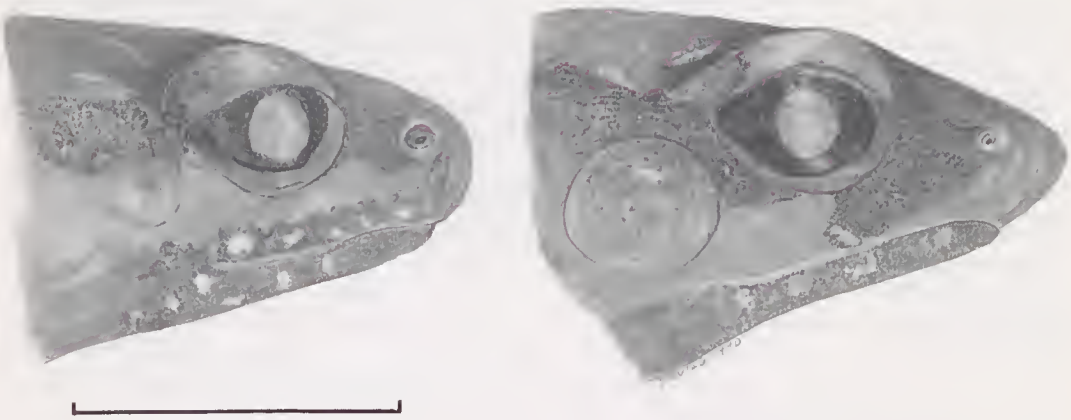


Fig. 5. Lateral views of heads of: A, male (SAM R35109), and B, female *S. adelphe* (SAM R35110). Note divergence in snout shape and tympanum size.

0.50-0.92 (0.66-0.82), E/S-V 0.10-0.12 (0.10-0.12), E-N/S-V 0.04-0.07 (0.07-0.08).

The female collected by us differs morphologically from the males. The tympanum in the specimen is extremely large and well defined (Fig. 5) whereas in the other material it is poorly defined and considerably smaller. In addition, the snout is more pointed in profile and overhangs an undershot jaw (Fig. 5). The shape of the snout corresponds to the description of *S. gracilipes* of Zweifel (1985). It may be that sexual dimorphism occurs elsewhere within *Spheuophryne*, but we cannot confirm this.

DISCUSSION

Our studies indicate that the frog fauna of Melville Island includes 14 species (Table 3). From our assessment of the habitat diversity existing upon the island and the fact that our sampling included all habitat types, this figure coincides with our anticipations, based on work on Groote Eylandt and upon the adjacent mainland.

Interest should centre more upon species that we failed to encounter on Melville island rather than those that occur there. By far the most conspicuous deficiency is the apparent absence of *Litoria rubella*, which is common and locally abundant over much of the northern half of the continent. We expected this species to be there, were familiar with its call and arrived when we judged the climatic conditions ideal for its activity. But despite extensive field survey we did not hear or see this species at any site that we visited.

The absence of *L. wotjulumensis* is less surprising. We did not locate any shallow rock-strewn creeks comparable to those where we have encountered the species elsewhere.

We were influenced to expect two species of *Uperoleia* largely because two species occur at Darwin and on Groote Eylandt. Their absence from the Cobourg Peninsula could be a consequence of inadequate collection during the wet season. We are confident, however, that only one species occurs on Melville Island.

Litoria pallida was located on Melville Island, but has not been reported from Cobourg Peninsula. The faunal survey of Cobourg Peninsula by Cogger and Lindner (1974) antedated the description of *L. pallida* Davies *et al.* (1983). There remains the possibility therefore that the species could have been included unrecognised amongst the material reported as *L. tornieri*. Accordingly, the se-

Table 3. Faunal comparisons of four peripheral portions of the Northern Territory.

Genus and Species	Melville Island	Cobourg Peninsula[1]	Darwin[2]	Groote Eylandt[3]
Cyclorana australis	+	+	+	-
Litoria bicolor	+	+	+	+
Litoria caerulea	+	+	+	+
Litoria microbelos	+	+	+	+
Litoria nasuta	+	+	+	+
Litoria pallida	+	-	+	-
Litoria rothii	+	+	+	+
Litoria rubella	-	+	+	+
Litoria tornieri	+	+	+	+
Litoria wotjulumensis	-	+	-	+
Crinia remota	+	+[4]	+[4]	+
Limnodynastes convexiusculus	+	+	+	+
Limnodynastes ornatus	+	+	+	+
Notaden melanoscaphus	+	-	+	-
Uperoleia inundata	+	-	+	+
Uperoleia lithomoda	-	-	+	+
Sphenophryne adelphe	+	+[5]	-	-

[1]Derived from Cogger and Lindner (1974)
[2]Derived from Tyler and Davies (1986)
[3]Derived from Tyler *et al.* (1986)
[4]Further analysis is required to determine if these populations represent *C. remota* or *C. bilingua*
[5]Reported as '*S. robusta*'

ries was examined by one of us (M.D.) but was found to include only *L. tornieri*.

The presence of *C. australis* here contrasted with its absence on Groote Eylandt, where we expected to find it. We noted that it was scarce on Melville island, whereas it is abundant upon the adjacent mainland. We were unable to identify any factor that would provide an explanation for these differences.

There are various coefficients that can be used to express degrees of faunal similarity between discrete geographic units. This study is the second in an anticipated continuing series of studies investigating tropical, insular amphibian faunas. Until a greater number of such studies has been completed we have not attempted to elucidate broader biogeographic relationships and degrees of faunal similarity.

ACKNOWLEDGEMENTS

For permission to visit Melville Island and to undertake our investigation there we are greatly indebted to the Tiwi Council. Our visit was made possible by the support of the Australian Research Council and the Conservation Commission of the Northern Territory (CCNT). We thank particularly CCNT staff who helped us in a variety of ways (Bill Freeland and Sarah Kerin), and Jeremy Russell-Smith who acted as our guide during the early portion of our visit.

Greg Sutton and John Gilham, of Melville Forest Products Pty Ltd provided support and transport on the island, whilst in Darwin we are grateful to the North Australia Research Unit of the Australian National University and particularly Jann King for facilities.

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Accepted 20 December 1990